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tions, a midnight argument, or one for another noon would be nearer to the assumed time) with those given for the particular eclipse, and tabulate the differences ; then find from these the corrections required for the assumed time in simple proportion, giving for the assumed time the R.A. and declination of the Sun, the H.P. and the Moon's semi-diameter. Then find the hour angle, and with the geocentric latitude compute the values in the direction of R.A. and declination of the parallax, the tangent to the elliptic curve, and the extent of one minute's motion and the Sun's altitude, and from this compute the augmentation. We are now in a position to lay down on paper two straight lines, one representing the soli-lunar motion to be drawn through the place as above found for the solar and lunar centres, and the other representing the tangent to the parallactic curve drawn through the corresponding point of parallax. Mark on these lines the extent of one minute's motion, both previous to and subsequent to the assumed time, produced as might be required, and subdivided into scales of seconds of time.

It is now easy, if totality be possible, to find the points where the extremities of a radius = S—s with its augmentation increment, will rest upon similar numbers of seconds on the soli-lunar and parallax scales, the western coincidence giving the second and the eastern the third contact.

Calculation of the times of 2nd and 3rd Contact for the Total Solar Eclipse at Ovar on 1900 May 28.

$$\left\{\begin{array}{ll} \text{Latitude of Ovar} & = \lambda = 40^\circ\ 51'\ \text{N.} \\ \text{Geocentric Latitude} = l & \left\{\begin{array}{l} \log \rho \sin l = 9{\cdot}81330 \\ \log \rho \cos l = 9{\cdot}87940 \end{array}\right. \\ \text{Longitude of Ovar} & = 34^{\text{m}}\ 32^{\text{s}}\ \text{W.} \end{array}\right.$$

Mid-totality at Ovar occurs at $4^{\text{h}}\ 2^{\text{m}}$ G.M.T. (approx.)

1900 May 28, $4^{\text{h}}\ 2^{\text{m}}$ G.M.T.

☉'s R.A. $= \alpha = 4^{\text{h}}\ 19^{\text{m}}\ 58^{\text{s}}{\cdot}33$. Change in $1^{\text{m}} = 0^{\text{s}}{\cdot}178$

☉'s Dec. $= \delta = 21^\circ\ 27'\ 41''{\cdot}9$. „ „ $= 0''{\cdot}405$

Hour Angle $= t = 3^{\text{h}}\ 30^{\text{m}}\ 26^{\text{s}}{\cdot}45$ E.

Altitude of ☉ $= 41^\circ\ 49'{\cdot}5$

☽'s R.A. $= \text{A} = 4^{\text{h}}\ 22^{\text{m}}\ 28^{\text{s}}{\cdot}76$. Change in $1^{\text{m}} = 2^{\text{s}}{\cdot}484$

☽'s Dec. $= \text{D} = 21^\circ\ 53'\ 6''{\cdot}36$. „ „ $= 2''{\cdot}529$

$$\left.\begin{array}{ll} \text{☽'s Hor. Par.} & = \text{P} = 58'\ 25''{\cdot}79 \\ \text{☉'s Hor. Par.} & = p = 8''{\cdot}73 \end{array}\right\} \quad \text{P}-p = 58'\ 17''{\cdot}06$$

$$\left.\begin{array}{ll} \text{☽'s Semi-diam.} & = \text{S} = 15'\ 55''{\cdot}30 \\ \text{☉'s Semi-diam.} & = s = 15'\ 46''{\cdot}49 \end{array}\right\} \quad \text{S}-s = 8''{\cdot}71$$

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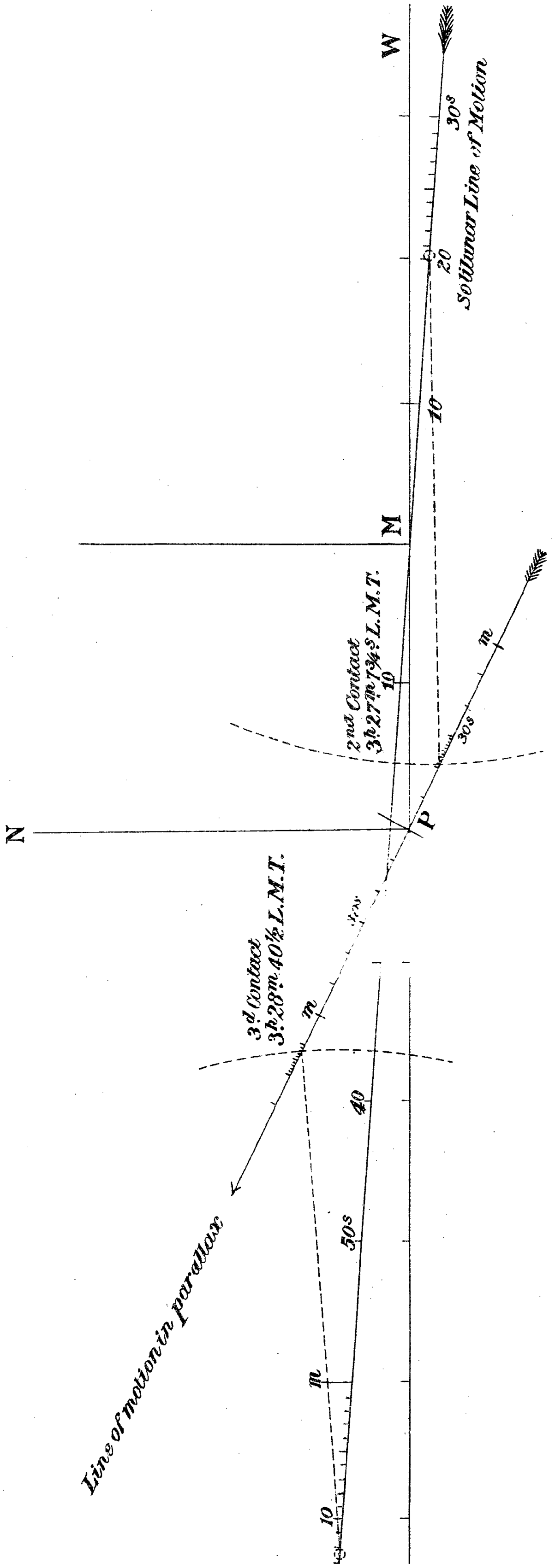

CIRCUMSTANCES OF THE TOTAL ECLIPSE AT OVAR
REDUCED GRAPHICALLY

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The augmentation of $S-s$ for Altitude $41^\circ\ 49'\cdot5 = 10''\cdot80$

$\therefore$ The augmented value of $S-s = 19''\cdot51$

The Parallax in R.A. $= (P-p)\ \rho \cos l \sin t$

$= 35'\ 4''\cdot75$

The Parallax in Dec. $= (P-p)\ (\rho \sin l \cos \delta - \rho \cos l \sin \delta \cos t)$

$= 25'\ 28''\cdot69$ (above the centre)

The Soli-lunar position in R.A. $= (A-a) \cos D$

$= 34'\ 53''\cdot85$ (E. of Minor Axis of parallactic ellipse)

" " " in Dec. $= D - \delta$

$= 25'\ 24''\cdot46.$

To this $4''\cdot20$ must be added, on account of the lunar orbit, making the position $25'\ 28''\cdot66$ above the centre.

The extent of motion of parallax in 1^m in R.A.

$$= (P-p)\ \rho \cos l \cos t\ \Delta t = 7''\cdot02.$$

The extent in Dec. $= (P-p)\ \rho \cos l \sin \delta \sin t\ \Delta t.$

Therefore the tangent of the angle at the parallax point

$$= \sin \delta \tan t = 25^\circ\ 35'.$$

The Soli-lunar motion in R.A. in $1^m = (2^s\cdot484 - 0^s\cdot178) \cos \delta$

$= 32''\cdot24$

" " " in Dec. in $1^m = 2''\cdot529 - 0''\cdot405$

$= 2''\cdot124.$

The diagram (Plate 14) is constructed from these elements: P is the parallax at $4^h\ 2^m$ and its line of motion is drawn. M is the Soli-lunar centre and its line of motion is drawn. The diagram shows that the second contact occurs $20^s\frac{1}{4}$ before $4^h\ 2^m$, and the third contact $1^m\ 12^s\frac{1}{2}$ after it.

An Application of Projective Geometry to Binary Star Orbits.

By H. C. Plummer.

1. In the numerous methods which have been employed in the determination of the orbits of double stars, it is natural, on account of the comparatively coarse nature of the observations, that much use has been made of graphical devices. These for the most part are of the "trial and error" kind. T. N. Thiele[*] and J. M. Wilson,[†] however, have given direct geometrical constructions by which the relations between the apparent and the

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[*] *A.N.* 1227.

[†] *M.N.* xxxiii. p. 375.